CLAIMS

1. An integrated optical waveguide structure comprising a waveguide core (113) for guiding an optical field, the waveguide core being formed over a lower cladding layer (111), wherein the waveguide core comprises a waveguide core layer (113a) substantially coextensive to the lower cladding layer and having a substantially uniform thickness (t), and a waveguide core rib (113b), protruding from a surface of the waveguide core layer opposite to a surface thereof facing the lower cladding layer, said waveguide core rib (113b) having a substantially uniform height (h-t), a layout of the waveguide core rib defining a path for the guided optical field,

characterized in that

the integrated optical waveguide structure comprises:

a circuit waveguide portion (117a), in which the waveguide core rib has a first width (W_0), adapted to guiding the optical field through an optical circuit, and

at least one coupling waveguide portion (101) adapted to coupling the circuit waveguide portion to an external optical field, said coupling waveguide portion comprising:

a terminal waveguide core rib portion (117c) having a second width (W) lower than the first width and terminating in a facet (119), and

a transition waveguide core rib portion (117b) optically joining to each other the core rib of the circuit waveguide portion and the terminal waveguide core

rib portion, said transition waveguide core rib portion being laterally-tapered so that a width thereof decreases from the first width to the second width.

2. The integrated optical waveguide structure according to claim 1, in which a ratio between the second width and the first width, and a ratio between the height of the waveguide core layer and an overall height (h) of the waveguide core are chosen in such a way as to keep coupling losses arising when the external optical field is coupled to the integrated waveguide below a prescribed level.

3. The integrated optical waveguide structure according to claim 2, in which at least among a value of the first width, a value of the height (t) of the waveguide core layer and a value of the overall height (h) of the waveguide core is chosen in such a way as to comply with requirements on the circuit waveguide portion depending on the optical circuit, and at least one among a value of the second width and a value of the height (t) of the waveguide core layer are chosen in such a way as to achieve a prescribed efficiency in the coupling of the integrated waveguide to an external optical field having first field dimensions (S_f).

4. The integrated optical waveguide structure according to claim 3, in which the circuit waveguide portion is designed to support an optical field of second field dimensions (S_{wg}) equal to or lower than the first

field dimensions, said coupling waveguide portion performing a field dimensions adaptation for adapting the second field dimensions to the first field dimensions .

5. The integrated optical waveguide structure according to claim 4, in which the circuit waveguide portion is designed in such a way as to support a single-mode optical field.

6. The integrated optical waveguide structure according to claim 4 or 5, in which a ratio (K) of the first field dimensions to the second field dimensions falls in the range from approximately 1 to approximately 3.

7. The integrated optical waveguide structure according to claim 6, in which the waveguide core is covered by an upper cladding (115).

8. The integrated optical waveguide structure according to claim 7, in which the lower cladding layer has a first refractive index (n_{1c}), the waveguide core has a second refractive index (n_{core}) and the upper cladding has a third refractive index (n_{uc}), the first, second and third refractive indexes being such that a refractive index contrast between the waveguide core and the lower and upper claddings falls in the range from approximately 1% to approximately 20%.

9. The integrated optical waveguide structure

according to claim 8, in which said refractive index contrast falls in the range from approximately 5% to approximately 7%.

10. The integrated optical waveguide structure according to claim 8 or 9, in which said waveguide core is made of silicon oxynitride (SiON).

11. The integrated optical waveguide structure according to claim 10, in which said lower cladding layer is made of silicon dioxide (SiO_2).

12. The integrated optical waveguide structure according to claim 10, in which said upper cladding is made of silicon dioxide (SiO_2) or gas, particularly air.

13. The integrated optical waveguide structure according to claim 1, in which a length (L) of said transition waveguide core rib portion is chosen in dependence of a ratio between the first width and the second width so as to be at least equal to a minimum length that, expressed in microns, is given by the formula $(1-W/W_0)*500$.

14. The integrated optical waveguide structure according to claim 13, in which said terminal waveguide core rib portion has a length (L_{tip}) chosen to be the shortest possible length taking account of technological tolerances in a process of separating a die in which the optical waveguide structure is integrated from other dies

formed from a same wafer.

15. The integrated optical waveguide structure according to claim 13, in which the length of the terminal waveguide core rib portion is determined, on the basis of said minimum length and of the length of the transition waveguide core rib portion, so as to be equal to a value that, expressed in microns, is given by the formula $L_{tec}\exp(-(L/L_{min})^2)$, where L_{tec} denotes a length depending on said technological tolerances and L_{min} is said minimum length.

16. A method of coupling an external optical field to an integrated optical waveguide of a type comprising a waveguide core (113) for guiding an optical field, formed over a lower cladding layer (111), wherein the waveguide core comprises a waveguide core layer (113a) substantially coextensive to the lower cladding layer and having a substantially uniform thickness (t), and a waveguide core rib (113b), protruding from a surface of the waveguide core layer opposite to a surface thereof facing the lower cladding layer, said waveguide core rib having a substantially uniform height (h-t), a layout of the waveguide core rib defining a path for the guided optical field,

characterized by comprising

providing at least one coupling waveguide portion (101) designed for coupling an external optical field to a circuit waveguide portion (117a) in which the waveguide core layer has a first width (W_0), adapted to guiding the

optical field through an optical circuit, said coupling portion comprising:

a terminal waveguide core rib portion (117c) having a second width (W) lower than the first width and terminating in a facet (119), and

a transition waveguide core rib portion (117b) optically joining to each other the waveguide core rib in the circuit waveguide portion and the terminal waveguide core rib portion, said transition waveguide core rib portion being laterally-tapered so that a respective width decreases from the first width to the second width.

17. The method according to claim 16, comprising:

choosing a ratio between the second width and the first width, and a ratio between the height of the waveguide core layer and an overall height (h) of the waveguide core in such a way as to keep coupling losses arising when the external optical field is coupled to the integrated waveguide below a prescribed level.

18. The method according to claim 17, comprising:

choosing at least one among a value of the first width, a value of the height (t) of the waveguide core layer and a value of the overall height (h) of the waveguide core in such a way as to comply with requirements on the circuit waveguide portion depending on the optical circuit, and

choosing at least one among a value of the second width and a value of the height (t) of the waveguide core layer in such a way as to achieve a prescribed efficiency

in the coupling of an external optical field having first field dimensions (S_f) to the integrated waveguide.

19. A process for manufacturing an integrated optical waveguide structure, comprising:

forming a lower cladding layer (111) over a substrate (109);

forming a waveguide core on the lower cladding layer, wherein said forming the waveguide core comprises:

forming a waveguide core layer (113a) substantially coextensive to the lower cladding layer and having substantially uniform thickness (t), and

forming a waveguide core rib (113b), protruding from a surface of the waveguide core layer opposite to a surface thereof facing the lower cladding layer, said waveguide core rib having a substantially uniform height (h-t), the waveguide core rib having a layout defining a path for the guided optical field

characterized in that

said forming the waveguide core rib further comprises:

forming at least one coupling waveguide portion (101) designed for coupling an external optical field to a circuit waveguide portion in which the waveguide core rib has a first width (W_0), said forming the at least one coupling waveguide portion comprising:

forming a terminal waveguide core rib portion (117c) having a second width (W) lower than the first width and terminating in a facet (119), and

forming a transition waveguide core rib portion

(117b) optically joining to each other the waveguide core rib in the circuit waveguide portion and the terminal waveguide core rib portion, said transition waveguide core rib portion being laterally-tapered so that a respective width decreases from the first width to the second width.

20. The process according to claim 19, in which said forming the waveguide core comprises:

forming a material layer over the lower cladding layer, and

selectively removing the material layer to define the waveguide core layer and the waveguide core rib.

21. The process according to claim 20, in which the terminal portion and the transition portion are formed simultaneously with said forming of the waveguide core rib.